

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**Patent Application**

Applicants: M.A.K. Alicherry et al.

Case: 6-3

Serial No.: 10/722,651

Filing Date: November 26, 2003

Group: 2128

Examiner: David Silver

Title: Methods and Apparatus for  
Line System Design

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**APPEAL BRIEF**

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313

Sir:

Applicants (hereinafter referred to as "Appellants") hereby appeal the final rejection of claims 1-9 and 11-29 of the above-identified application.

**REAL PARTY IN INTEREST**

The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded March 25, 2004, in the U.S. Patent and Trademark Office at Reel 015153, Frame 0500. On November 30, 2006, the assignee Lucent Technologies Inc. completed a merger with Alcatel S.A., with the resulting entity being named Alcatel-Lucent. Alcatel-Lucent is the real party in interest.

**RELATED APPEALS AND INTERFERENCES**

There are no known related appeals or interferences.

### STATUS OF CLAIMS

The present application was filed on November 26, 2003 with claims 1-29. Claim 10 was canceled in a previous amendment. Claims 1-9 and 11-29 remain pending. Claims 1, 8, 11, 15, 22, 25 and 29 are the pending independent claims.

Claims 1-9 and 11-29 are rejected under 35 U.S.C. §101. Claims 1-7, 9, 14-21, 23, 24 and 26-29 are rejected under 35 U.S.C. §102(e).

Appellants respectfully note that the final Office Action indicates only claims 8, 11, 22 and 25 as having allowable subject matter. See the paragraph numbered 9.1 on page 3 of the final Office Action and the paragraph numbered 14 on page 7 of the final Office Action. However, claims 8, 11-13, 22 and 25 are rejected only under §101. As such, claims 12 and 13 should also be indicated as having allowable subject matter.

Claims 1-9 and 11-29 are appealed.

### STATUS OF AMENDMENTS

In an amendment filed on September 17, 2008, Appellants proposed amending claim 12 to depend from independent claim 11, rather than canceled claim 10. In an Advisory Action dated October 6, 2008, the Examiner refused entry on the grounds that the proposed amendment “significantly alters the scope of the invention” and thus “must be considered for compliance with 35 U.S.C. §112 / 101 as well as consideration whether it can be rejected based on prior-art.”

Appellants initially note that claim 12, if amended as proposed, would depend from claim 11, which was indicated as containing allowable subject matter. As such, amended claim 12 could not have been rejected based on prior art, thus rendering consideration of this issue unnecessary. See, e.g., *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) (holding that if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious).

Moreover, although the Examiner correctly indicated that canceled claim 10 was dependent on claim 1, whereas claim 11 is independent, it is important to note that originally-filed claim 11 was dependent from claim 10, and was subsequently rewritten in independent form including the limitations of claim 10, and hence of claim 1. Accordingly, the proposed amendment of claim 12 to depend from claim 11 rather than claim 10 requires no further consideration and/or search, much less

raises issues of whether amended claim 12 would comply with 35 U.S.C. §112 or be drawn to a separate invention, as suggested in the Advisory Action.

#### SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 is directed to a method of designing a line system. The method includes a computer performing a step of obtaining a set of one or more demands for use in computing the line system design. The one or more demands comprise one or more bandwidth requests. The method also includes a computer performing a step of representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. The method includes a computer performing a further step of specifying a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 7, line 26, to page 8, line 2, an exemplary method of designing a line system (e.g., 100 in FIG. 1, described in the specification at page 1, lines 16-23) includes a computer (e.g., 300 in FIG. 3 or 500 in FIG. 5; see the specification at, for example, page 16, lines 9-15) performing a step of obtaining a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 3, lines 24-26, the one or more demands comprise one or more bandwidth requests. As described in the specification at, for example, page 4, lines 23-30, the method includes a computer performing an additional step of representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 8, lines 2-11, the method includes a computer performing a further step of specifying a line system design based on the assigned bandwidths and the routed demands.

Independent claim 8 is directed to a method of designing a line system. The method includes a computer performing a step of obtaining a set of one or more demands for use in computing the line system design. The method also includes a computer performing a step of representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent

bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. The method further includes a computer performing a step of computing the graph coloring operation to an  $O(\sqrt{s})$  -approximation, where  $s$  is a value proportional to a number of color sets. The method includes a computer performing a further step of specifying a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 7, line 26, to page 8, line 2, an exemplary method of designing a line system (e.g., 100 in FIG. 1, described in the specification at page 1, lines 16-23) includes a computer (e.g., 300 in FIG. 3 or 500 in FIG. 5; see the specification at, for example, page 16, lines 9-15) performing a step of obtaining a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 4, lines 23-30, the method also includes a computer performing a step of representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 5, lines 1-4, and page 13, line 17, to page 14, line 6, with reference to FIG. 4F, the method includes a computer performing an additional step of computing the graph coloring operation to an  $O(\sqrt{s})$  -approximation, where  $s$  is a value proportional to a number of color sets. As described in the specification at, for example, page 8, lines 2-11, the method includes a computer performing a further step of specifying a line system design based on the assigned bandwidths and the routed demands.

Independent claim 11 is directed to a method of designing a line system. The method includes a computer performing a step of obtaining a set of one or more demands for use in computing the line system design. The line system being designed is a circular line system. The method also includes a computer performing a step of representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. The method includes a computer performing an additional step of computing the graph coloring operation to a  $2(1 + \epsilon)$ -approximation. The method includes a

computer performing a further step of specifying a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 7, line 26, to page 8, line 2, an exemplary method of designing a line system (e.g., 100 in FIG. 1, described in the specification at page 1, lines 16-23) includes a computer (e.g., 300 in FIG. 3 or 500 in FIG. 5; see the specification at, for example, page 16, lines 9-15) performing a step of obtaining a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 5, lines 13-19, and page 6, lines 18-23, the line system being designed is a circular line system. As described in the specification at, for example, page 4, lines 23-30, the method also includes a computer performing a step of representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 5, lines 4-6, and page 9, line 15, to page 11, line 15, with reference to FIG. 4B, the method includes a computer performing an additional step of computing the graph coloring operation to a  $2(1 + \epsilon)$ -approximation. As described in the specification at, for example, page 8, lines 2-11, the method includes a computer performing a further step of specifying a line system design based on the assigned bandwidths and the routed demands.

Independent claim 15 is directed to an apparatus for designing a line system. The apparatus comprises a memory and at least one processor coupled to the memory. The at least one processor is configured to obtain a set of one or more demands for use in computing the line system design. The one or more demands comprise one or more bandwidth requests. The at least one processor is also configured to represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. The at least one processor is further configured to specify a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 16, lines 8-28, an exemplary apparatus (e.g., 500 in FIG. 5) for designing a line system (e.g., 100 in FIG. 1, described in the specification at

page 1, lines 16-23) comprises a memory (e.g., 504 in FIG. 5) and at least one processor (e.g., 502 in FIG. 5) coupled to the memory. As described in the specification at, for example, page 7, line 26, to page 8, line 2, the at least one processor is configured to obtain a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 3, lines 24-26, the one or more demands comprise one or more bandwidth requests. As described in the specification at, for example, page 4, lines 23-30, the at least one processor is also configured to represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 8, lines 2-11, the at least one processor is further configured to specify a line system design based on the assigned bandwidths and the routed demands.

Independent claim 22 is directed to an apparatus for designing a line system. The apparatus comprises a memory and at least one processor coupled to the memory. The at least one processor is configured to obtain a set of one or more demands for use in computing the line system design. The at least one processor is also configured to represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. The at least one processor is additionally configured to compute the graph coloring operation to an  $O(\sqrt{s})$  -approximation, where  $s$  is a value proportional to a number of color sets. The at least one processor is further configured to specify a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 16, lines 8-28, an exemplary apparatus (e.g., 500 in FIG. 5) for designing a line system (e.g., 100 in FIG. 1, described in the specification at page 1, lines 16-23) comprises a memory (e.g., 504 in FIG. 5) and at least one processor (e.g., 502 in FIG. 5) coupled to the memory. As described in the specification at, for example, page 7, line 26, to page 8, line 2, the at least one processor is configured to obtain a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 4, lines 23-30, the at least one processor is also configured to represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that

bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 5, lines 1-4, and page 13, line 17, to page 14, line 6, with reference to FIG. 4F, the at least one processor is additionally configured to compute the graph coloring operation to an  $O(\sqrt{s})$  -approximation, where  $s$  is a value proportional to a number of color sets. As described in the specification at, for example, page 8, lines 2-11, the at least one processor is further configured to specify a line system design based on the assigned bandwidths and the routed demands.

Independent claim 25 is directed to an apparatus for designing a line system. The apparatus comprises a memory and at least one processor coupled to the memory. The at least one processor is configured to obtain a set of one or more demands for use in computing the line system design. The line system being designed is a circular line system. The at least one processor is also configured to represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. The at least one processor is additionally configured to compute the graph coloring operation to a  $2(1 + \epsilon)$ -approximation. The at least one processor is further configured to specify a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 16, lines 8-28, an exemplary apparatus (e.g., 500 in FIG. 5) for designing a line system (e.g., 100 in FIG. 1, described in the specification at page 1, lines 16-23) comprises a memory (e.g., 504 in FIG. 5) and at least one processor (e.g., 502 in FIG. 5) coupled to the memory. As described in the specification at, for example, page 7, line 26, to page 8, line 2, the at least one processor is configured to obtain a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 5, lines 13-19, and page 6, lines 18-23, the line system being designed is a circular line system. As described in the specification at, for example, page 4, lines 23-30, the at least one processor is also configured to represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 5, lines 4-6, and page 9, line 15, to page 11, line 15, with reference to FIG. 4B, the

at least one processor is additionally configured to compute the graph coloring operation to a  $2(1 + \epsilon)$ -approximation. As described in the specification at, for example, page 8, lines 2-11, the at least one processor is also configured to specify a line system design based on the assigned bandwidths and the routed demands.

Independent claim 29 is directed to an article of manufacture for designing a line system, comprising a machine readable storage medium containing one or more programs, which when executed, implement certain steps. These steps include obtaining a set of one or more demands for use in computing the line system design. The one or more demands comprise one or more bandwidth requests. These steps also include representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. These steps further include specifying a line system design based on the assigned bandwidths and the routed demands.

As described in the specification at, for example, page 17, lines 17-31, an article of manufacture for designing a line system (e.g., 100 in FIG. 1, described in the specification at page 1, lines 16-23), comprises a machine readable storage medium containing one or more programs, which when executed, implement certain steps. As described in the specification at, for example, page 7, line 26, to page 8, line 2, obtaining a set of one or more demands for use in computing the line system design. As described in the specification at, for example, page 3, lines 24-26, the one or more demands comprise one or more bandwidth requests. As described in the specification at, for example, page 4, lines 23-30, these steps also include representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost. As described in the specification at, for example, page 8, lines 2-11, these steps further include specifying a line system design based on the assigned bandwidths and the routed demands.

Illustrative embodiments of the present invention allow for performance of efficient routing and coloring operations in line systems. More particularly, illustrative embodiments of the present invention provide efficient optimal and approximation methodologies for solving different versions

of the line system design problem. The results of these methodologies may then be implemented so as to realize an efficiently designed line system. See the specification at, for example, page 3, lines 21-24, and page 7, line 14, to page 8, line 11.

#### GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1-9 and 11-29 are rejected under 35 U.S.C. §101 as directed to non-statutory subject matter.
2. Claims 1-7, 9, 14-21, 23, 24 and 26-29 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. 2004/0061701 (hereinafter “Arquie”).

#### ARGUMENT

##### 1. Rejection of claims 1-9 and 11-29 under §101

###### Claims 1-9 and 11-14

With regard to the §101 rejection of claims 1, 8 and 11, each of which is directed to “a method of designing a line system,” the Examiner’s rejection relies on the “useful, concrete and tangible result” test described in MPEP 2106. Appellants respectfully note that the Federal Circuit has recently repudiated this test. See *In re Bilski*, 545 F.3d 943, 88 USPQ2d 1385, 1395 & n.19 (Fed. Cir. 2008) (“[W]e also conclude that the ‘useful, concrete and tangible result’ inquiry is inadequate and reaffirm that the machine-or-transformation test outlined by the Supreme Court is the proper test to apply. As a result, those portions of our opinions in State Street and AT&T relying solely on a ‘useful, concrete and tangible result’ analysis should no longer be relied on.”)

Rather, there is “a definitive test to determine whether a process claim is tailored narrowly enough to encompass only a particular application of a fundamental principle rather than to pre-empt the principle itself. A claimed process is surely patent-eligible under § 101 if: (1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing.” *id.* at 1391 (emphasis in original). See also *id.* at 1396 (“The machine-or-transformation test is a two-branched inquiry; an applicant may show that a process claim satisfies § 101 either by showing that his claim is tied to a particular machine, or by showing that his claim transforms an article.”)

Appellants respectfully submit that, although it is sufficient that one of the two branches of this machine-or-transformation test be satisfied, claims 1, 8 and 11 in fact satisfy both branches of this test. Specifically, each of claims 1, 8 and 11 specifically recite that the method comprises a computer performing the enumerated steps, and hence are “tied to a particular machine” namely, a computer. See, e.g., *id.* at 1396 (citing *In re Comiskey*, 499 F.3d 1365, 1379 (Fed. Cir. 2007)) (noting that the Federal Circuit has consistently rejected process claims like those in *Bilski* and in *Comiskey* as unpatentable under §101 because “these claims do not require a machine”).

Turning now to the transformation branch, we note that the Federal Circuit stated that when a “claimed process is limited to a practical application of a fundamental principle to transform specific data, and the claim is limited to a visual depiction that represents specific physical objects or substances, there is no danger that the scope of the claim would wholly pre-empt all uses of the principle.” *In re Bilski*, 88 USPQ2d at 1397. See also *id.* at 1398 (indicating that patentable claims “involve the transformation of any physical object or substance, or an electronic signal representative of any physical object or substance.”)

In the present case, claims 1, 8 and 11 include limitations directed to “specifying a line system design,” which involves the transformation of “an electronic signal representative of any physical object,” and “representing the line system design as a graph in accordance with a graph coloring operation,” which is “a visual depiction that represents specific physical objects.” For example, in an illustrative embodiment, the line system design may correspond to the optical line system shown in FIG. 1 and described in the specification at, for example, page 1, lines 16-23.

In view of the above, independent claims 1, 8 and 11 each recite statutory subject matter, as do their dependent claims 2-7, 9 and 12-14.

#### Claims 15-28

With regard to the §101 rejection of claims 15, 22 and 25, Appellants initially note that each of these claims is directed to an apparatus for designing a line system, and further specify that the apparatus comprises a memory and at least one processor coupled to the memory and configured to perform certain operations. In the Advisory Action at page 2, second paragraph, the Examiner concedes that “one having skill in the art would clearly understand that a processor performs

operations by executing stored instructions,” then argues that “whether one understands that a processor performs operations by executing instructions does not add merit that the language of ‘configured to’ means an active step of performing instruction execution.”

Appellants respectfully submit that the Federal Circuit has held that “programming creates a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software. . . . Consequently, a computer operating pursuant to software may represent patentable subject matter. . . .” *In re Alappat*, 33 F.3d 1526, 1545, 31 USPQ2d 1545, 1558 (Fed. Cir. 1994) (emphasis added). Accord. *Aristocrat Techs. Australia Pty. Ltd. v. Intl. Game Tech.*, 521 F.3d 1328, 86 USPQ2d 1235, 1239 (Fed. Cir. 2008). As such, the recited “processor configured to” perform specified operations by executing stored instructions represents patent-eligible subject matter.

In view of the above, claims 15, 22 and 25 each recite statutory subject matter, as do their dependent claims 16-21, 23, 24 and 26-28.

#### Claim 29

Regarding the §101 rejection of claim 29, Appellants respectfully submit that “an article of manufacture for designing a line system, comprising a machine readable storage medium containing one or more programs which when executed implement” a patentable process constitutes a proper claim of statutory subject matter. See, e.g., *In re Beauregard*, 53 F.3d 1583, 35 USPQ2d 1383 (Fed. Cir. 1995); *In re Lowry*, 32 F.3d 1579, 32 USPQ2d 1031 (Fed. Cir. 1994).

#### 2. Rejection of claims 1-7, 9, 14-21, 23, 24 and 26-29 under §102(e) as being anticipated by Arquie.

##### Claims 1, 3, 4, 6, 7, 14, 15, 17, 18, 20, 21, 24 and 26-28

In formulating the §102 rejection of claim 1, the Examiner indicates that certain claim limitations have not been given patentable weight. Appellants respectfully submit that the Examiner’s failure to consider these limitations is improper and constitutes piecemeal examination of the sort specifically prohibited by MPEP 707.07(g). See also *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970) (“All words in a claim must be considered in judging the patentability of that claim against the prior art.”)

The Examiner characterizes the limitations of claim 1 which recite (emphasis in original) “obtaining a set of one or more demands *for use in computing the line system design*,” and “representing the line system design as a graph in accordance with a graph coloring operation wherein . . . the one or more demands are routed *so as to attempt to achieve a minimum total design cost*,” as being drawn to intended use and hence not given patentable weight.

In making this assertion, the Examiner relies upon *Minton v. Nat'l Ass'n of Securities Dealers, Inc.*, 336 F.3d 1373, 1381, 67 USPQ2d 1614, 1620 (Fed. Cir. 2003), as cited in MPEP 2111.04. However, it should be noted that the MPEP section in question reads, in relevant part:

The determination of whether each of these clauses [e.g., ‘adapted to,’ ‘adapted for,’ ‘wherein,’ and ‘whereby’ clauses] is a limitation in a claim depends on the specific facts of the case.” In *Hoffer v. Microsoft Corp.*, 405 F.3d 1326, 1329, 74 USPQ2d 1481, 1483 (Fed. Cir. 2005), the court acknowledged (quoting *Minton*, 336 F.3d at 1381, 67 USPQ2d at 1620) that a “whereby clause in a method claim is not given weight when it simply expresses the intended result of a process step positively recited,” but then held that when a whereby “clause states a condition that is material to patentability, it cannot be ignored in order to change the substance of the invention.”

Indeed, Appellants respectfully submit that the claim limitations at issue are analogous to that upheld in *Hoffer*, in which the whereby clause described “a network of users at multiple remote user terminals who are ‘collectively able to concurrently engage in interactive data messaging.’ This capability is more than the intended result of a process step; it is part of the process itself.” 405 F.3d at 1329, 74 USPQ2d at 1483.

These limitations directed to “obtaining a set of one or more demands *for use in computing the line system design*,” and “representing the line system design as a graph in accordance with a graph coloring operation wherein . . . the one or more demands are routed *so as to attempt to achieve a minimum total design cost*,” recite parts of the process itself rather than simple expressions of intended results of process steps. Accordingly, these claims should be afforded patentable weight.

Moreover, these clauses state conditions that are material to patentability. Appellants note that a claim is anticipated “only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) (emphasis added). Indeed, the reference must disclose “within the four corners of the document not only all of the limitations

claimed but also all of the limitations arranged or combined in the same way as recited in the claim.”  
*Net MoneyIN Inc. v. VeriSign Inc.*, 545 F.3d 1359, 1369, 88 USPQ2d 1751, 1760 (Fed. Cir. 2008)  
(emphasis added)

In this case, Appellants assert that Arquie clearly fails to teach or even suggest each and every limitation of the claims. For example, Arquie does not disclose the limitation recited in claim 1 directed to representing a line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost.

The final Office Action cites paragraph [0013] of Arquie for the purpose of suggesting that “adding color [] such that particular performance ranges are essentially color-coded” teaches this claim limitation. However, this portion of Arquie completely fails to teach, or even suggest, the claim limitation at issue. That is, Arquie mentions nothing about colors representing bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost.

Independent claim 15 is believed to be patentable for at least the reasons similar to those recited above with reference to claim 1. Dependent claims 3, 4, 6, 7, 14, 17, 18, 20, 21, 24 and 26-28 are also believed patentable at least by virtue of their respective dependencies from claims 1 and 15.

### Claims 2 and 16

Dependent claims 2 and 16 are patentable at least by virtue of their respective dependencies from claims 1 and 15. Moreover, these claims define additional separately patentable subject matter. Specifically, claims 2 and 16 include limitations wherein colors are partitioned in sets and the sets are ordered so that colors in higher sets cost more than colors in lower sets.

The final Office Action cites paragraph [0013] of Arquie for the purpose of suggesting that “adding color [] such that particular performance ranges are essentially color-coded” teaches or suggests this claim limitation. Appellants respectfully submit that Arquie does not describe partitioning colors into sets. Rather, Arquie describes an arrangement in which “a different color is assigned to each of the performance ranges.” See Arquie at paragraph [0052]; see also Arquie at paragraphs [0013] and [0016], as well as claims 13 and 20.

Moreover, Arquie fails to teach an arrangement wherein sets are ordered so that colors in higher sets cost more than colors in lower sets. Indeed, there is no teaching or suggestion in Arquie that a color is associated with a cost, much less that sets of colors are ordered according to their costs. Rather, as noted above, Arquie discloses an arrangement in which “a different color is assigned to each of the performance ranges.” It is important to note that there is no teaching or suggestion in Arquie that these performance ranges are in any way associated with respective costs.

#### Claims 5 and 19

Dependent claims 5 and 19 are patentable at least by virtue of their respective dependencies from claims 1 and 2 and from claims 15 and 16. Moreover, these claims define additional separately patentable subject matter. Specifically, claims 5 and 19 include limitations wherein colors are assigned to the demands such that no two demands routed on the same link of the graph are assigned the same color.

The final Office Action claims that these limitations are taught by Arquie at paragraphs [0053] and [0057]. Appellants respectfully submit that the relied-upon portions of Arquie contain no teaching or suggestion related to assignment of colors to demands, much less doing so such that no two demands routed on the same link of the graph are assigned the same color.

Indeed, the only arrangements which Arquie discloses in which colors are assigned to multiple channels of a given link are those shown in FIGS. 4, 5 and 7. Each of these arrangements clearly show that the link identified in FIG. 3 with reference numeral 338 has two channels (438 and 439 in FIG. 4, 538 and 539 in FIG. 5, and 738 and 739 in FIG. 7) which are assigned the same color.

See Arquie at paragraph [0041] (“[T]he display 410 is different from the pure topology display 310 in that the single line links or connections have been replaced with double-lined connections or performance-indicating links that include a line for each communication channel or fiber, e.g., 2 lines for a typical connection representing a receive channel and a transmit channel.”) and [0047] (“Connection 438 is shown with data flowing to switch 432 at a utilization rate of 40 to 60 percent while data is flowing away from switch 432 in connection 439 at a utilization rate of 40 to 60 percent.”)

### Claims 9 and 23

Dependent claims 9 and 23 are patentable at least by virtue of their respective dependencies from claims 1 and 15. Moreover, these claims define additional separately patentable subject matter. Specifically, claims 9 and 23 include limitations directed to polynomially computing the graph coloring operation.

The final Office Action claims that these limitations are taught by the legend shown in FIG. 7 of Arquie. Appellants respectfully submit that this legend merely shows the performance range which is either automatically or manually assigned to each color. See, e.g., Arquie at paragraphs [0045] and [0052]-[0055], as well as claims 16, 18, 20 and 22. There is no teaching or suggestion regarding polynomially computing a graph coloring operation either in this legend or anywhere else in Arquie.

### Claim 29

The §102 rejection of claim 29 the final Office Action at page 6, last paragraph, reads, “[a]s per claims [sic] 29, note the rejection of claims 8, 11 above. The Instant Claims [sic] recite substantially same [sic] limitations as the above-rejected claims and are therefore rejected under same [sic] prior-art teachings.”

Appellants respectfully submit that the final Office Action does not include any prior art rejections of claims 8 and 11, which are indicated as containing allowable subject matter. See the paragraph numbered 9.1 on page 3 of the final Office Action and the paragraph numbered 14 on page 7 of the final Office Action.

As such, the present §102 rejection of claim 29 fails to comply with 35 U.S.C. §132(a) (“Whenever, on examination, any claim for a patent is rejected, or any objection or requirement made, the Director shall notify the applicant thereof, stating the reasons for such rejection, or objection or requirement, together with such information and references as may be useful in judging of the propriety of continuing the prosecution of his application.”) and 37 C.F.R. §1.104(c)(2) (“In rejecting claims for want of novelty or for obviousness, the examiner must cite the best references at his or her command. When a reference is complex or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated

as nearly as practicable. The pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified.”)

In addition to being procedurally improper, the rejection of claim 29 is also substantively incorrect. Specifically, claim 29 includes limitations similar to those discussed above with reference to claim 1, and is hence believed to be patentable for reasons similar to those identified above with reference to claim 1.

In view of the above, Appellants respectfully submit that claims 1-9 and 11-29 are in condition for allowance, and respectfully request the reversal of the §101 and §102 rejections.

Respectfully submitted,

/des/

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## CLAIMS APPENDIX

1. A method of designing a line system, the method comprising a computer performing the steps of:
  - obtaining a set of one or more demands for use in computing the line system design, wherein the one or more demands comprise one or more bandwidth requests;
  - representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost; and
  - specifying a line system design based on the assigned bandwidths and the routed demands.
2. The method of claim 1, wherein colors are partitioned in sets and the sets are ordered so that colors in higher sets cost more than colors in lower sets.
3. The method of claim 2, wherein a link of the graph represents a location of a component of the line system being designed.
4. The method of claim 3, wherein a cost of a link in a coloring is equal to a cost of the most expensive set such that a demand going through the link is colored with a color in the most expensive set.
5. The method of claim 3, further wherein colors are assigned to the demands such that no two demands routed on the same link of the graph are assigned the same color.

6. The method of claim 1, wherein the line system being designed is a linear line system.
7. The method of claim 6, further comprising the step of representing the line system design by an interval graph.
8. A method of designing a line system, the method comprising a computer performing the steps of:
  - obtaining a set of one or more demands for use in computing the line system design;
  - representing the line system design as a graph in accordance with a graph coloring operation, wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost;
  - computing the graph coloring operation to an  $O(\sqrt{s})$  -approximation, where  $s$  is a value proportional to a number of color sets; and
  - specifying a line system design based on the assigned bandwidths and the routed demands.
9. The method of claim 1, further comprising the step of polynomially computing the graph coloring operation.
10. (Canceled).

11. A method of designing a line system, the method comprising a computer performing the steps of:

obtaining a set of one or more demands for use in computing the line system design, wherein the line system being designed is a circular line system;

representing the line system design as a graph in accordance with a graph coloring operation, wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost;

computing the graph coloring operation to a  $2(1 + \epsilon)$ -approximation; and

specifying a line system design based on the assigned bandwidths and the routed demands.

12. The method of claim 10, wherein a link of the graph represents a location of a component of the circular line system being designed.

13. The method of claim 12, wherein a demand is routed either clockwise or counterclockwise and colors are assigned to demands such that no two demands routed on the same link are assigned the same color.

14. The method of claim 1, wherein the line system being designed is an optical line system.

15. Apparatus for designing a line system, the apparatus comprising:  
a memory; and

at least one processor coupled to the memory and configured to: (i) obtain a set of one or more demands for use in computing the line system design, wherein the one or more demands comprise one or more bandwidth requests; (ii) represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost; and (iii) specify a line system design based on the assigned bandwidths and the routed demands.

16. The apparatus of claim 15, wherein colors are partitioned in sets and the sets are ordered so that colors in higher sets cost more than colors in lower sets.

17. The apparatus of claim 16, wherein a link of the graph represents a location of a component of the line system being designed.

18. The apparatus of claim 17, wherein a cost of a link in a coloring is equal to a cost of the most expensive set such that a demand going through the link is colored with a color in the most expensive set.

19. The apparatus of claim 17, further wherein colors are assigned to the demands such that no two demands routed on the same link of the graph are assigned the same color.

20. The apparatus of claim 15, wherein the line system being designed is a linear line system.

21. The apparatus of claim 20, wherein the processor is further configured to represent the line system design by an interval graph.

22. Apparatus for designing a line system, the apparatus comprising:  
a memory; and  
at least one processor coupled to the memory and configured to: (i) obtain a set of one or more demands for use in computing the line system design; (ii) represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost; (iii) compute the graph coloring operation to an  $O(\sqrt{s})$  -approximation, where  $s$  is a value proportional to a number of color sets; and (iv) specify a line system design based on the assigned bandwidths and the routed demands.

23. The apparatus of claim 15, wherein the processor is further configured to polynomially compute the graph coloring operation.

24. The apparatus of claim 15, wherein the line system being designed is a circular line system.

25. Apparatus for designing a line system, the apparatus comprising:  
a memory; and  
at least one processor coupled to the memory and configured to: (i) obtain a set of one or more demands for use in computing the line system design, wherein the line system being designed is a circular line system; (ii) represent the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost; (iii) compute the graph coloring operation to a  $2(1 + \epsilon)$ -approximation; and (iv) specify a line system design based on the assigned bandwidths and the routed demands.

26. The apparatus of claim 24, wherein a link of the graph represents a location of a component of the circular line system being designed.

27. The apparatus of claim 26, wherein a demand is routed either clockwise or counterclockwise and colors are assigned to demands such that no two demands routed on the same link are assigned the same color.

28. The apparatus of claim 15, wherein the line system being designed is an optical line system.

29. An article of manufacture for designing a line system, comprising a machine readable storage medium containing one or more programs which when executed implement the steps of:

obtaining a set of one or more demands for use in computing the line system design, wherein the one or more demands comprise one or more bandwidth requests;

representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost; and

specifying a line system design based on the assigned bandwidths and the routed demands.

## EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.